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A report to the
Lenin Academy of Agricultural Sciences
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REPORT BY

TROFIM DENISOVICH LYSENKO

TO THE

LENIN ACADEMY OF AGRICULTURAL SCIENCES

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THE SITUATION IN THE SCIENCE OF BIOLOGY

(Address delivered by Academician Trofim Denisovich Lysenko at a session of the All-Union Lenin Academy of Agricultural Sciences, 31 *July—*7 *August* 1948)

1. BIOLOGY, THE BASIS OF AGRONOMY

AGRONOMY deals with living bodies—plants, animals, micro-organisms. A theoretical grounding in agronomy must, therefore, include knowledge of biological laws. And the more profoundly the science of biology reveals the laws of the life and development of living bodies, the more effective is the science of agronomy.

In essence, the science of agronomy is inseparable from biology. When we speak of the theory of agronomy we mean the discovered and comprehended laws of the life and development of plants, animals, and micro-organisms.

The methodological level of biological knowledge, the state of the science treating of the laws of the life and development of vegetable and animal forms, i.e., primarily of the science known for half a century now as genetics, is of essential importance for our agricultural science.

2. THE HISTORY OF BIOLOGY: A HISTORY OF IDEOLOGICAL CONTROVERSY

THE appearance of Darwin's teaching, expounded in his book, *The Origin of Species,* marked the beginning of scientific biology.

The primary idea in Darwin's theory is his teaching on natural and artificial selection. Selection of variations favourable to the

organism has produced the purposefulness which we observe in living nature, in the structure of organisms and their adaptation to their conditions of life. Darwin's theory of selection provided a rational explanation of the purposefulness observable in living nature. His idea of selection is scientific and true. In substance, his teaching on selection is a summation of the age-old practical experience of plant and animal breeders who, long before Darwin, produced strains of plants and breeds of animals by the empirical method.

Darwin investigated the numerous facts obtained by naturalists in living nature and analysed them through the prism of practical experience. Agricultural practice served Darwin as the material basis for the elaboration of his theory of Evolution, which explained the natural causation of the adaptation we see in the structure of the organic world. That was a great advance in the knowledge of living nature.

In Engels' opinion, three great discoveries enabled man's knowledge of the inter-connection of natural processes to advance by leaps and bounds: first, the discovery of the cell; second, the discovery of the transformation of energy; third, " the proof which Darwin first developed in connected form that the stock of organic products of nature surrounding us today, including mankind, is the result of a long process of evolution from a few original unicellular germs, and that these again have arisen from protoplasm or albumen which came into existence by chemical means."[1]

The classics of Marxism, while fully appreciating the significance of the Darwinian theory, pointed out the errors of which Darwin was guilty. Darwin's theory, though unquestionably materialist in its main features, is not free from some serious errors. A major fault, for example, is the fact that, along with the materialist principle, Darwin introduced into his theory of evolution reactionary Malthusian ideas. In our days this major fault is being aggravated by reactionary biologists.

Darwin himself recorded the fact that he accepted the Malthusian idea. In his *Autobiography* we read:

" In October 1838, that is, fifteen months after I had begun my systematic enquiry, I happened to read for amusement *Malthus on Population,* and, being well prepared to appreciate the struggle for existence which everywhere goes on from long-continued observa-

[1] F. Engels, *Ludwig Feuerbach and the Outcome of Classical German Philosophy.*

tion of the habits of animals and plants, it at once struck me that under these circumstances favourable variations would tend to be preserved, and unfavourable ones to be destroyed. Here then *I had* at last *got a theory by which to work.*" [My emphasis—T. L.]

Many are still apt to slur over Darwin's error in transferring into his teaching Malthus's preposterous reactionary ideas on population. The true scientist cannot and must not overlook the erroneous aspects of Darwin's teaching.

Biologists should always ponder these words of Engels: "The entire Darwinian teaching on the struggle for existence merely transfers from society to the realm of living nature Hobbes's teaching on *bellum omnium contra omnes* and the bourgeois economic teaching on competition, along with Malthus's population theory. After this trick (the absolute justification for which I deny, particularly in regard to Malthus's theory) has been performed, the same theories are transferred back from organic nature to history and the claim is then made that it has been proved that they have the force of eternal laws of human society. The childishness of this procedure is obvious, and it is not worth while wasting words on it. But if I were to dwell on this at greater length, I should have started out by showing that they are poor *economists* first, and only then that they are poor naturalists and philosophers."[2]

For the propaganda of his reactionary ideas Malthus invented an allegedly natural law. "The cause to which I allude", he wrote, "is the constant tendency in all animated life to increase beyond the nourishment prepared for it."[3]

It must be clear to any progressively thinking Darwinist that, even though Darwin accepted Malthus's reactionary theory, it basically contradicts the materialist principle of his own teaching. Darwin himself, as may be easily noted, being as he was a great naturalist, the founder of scientific biology, whose activity marks an epoch in science, could not be satisfied with the Malthusian theory, since it is, in fact and fundamentally, in contradiction to the phenomena of living nature.

Under the weight of the vast amount of biological facts accumulated by him, Darwin felt constrained in a number of cases radically to alter the concept of the "struggle for existence", to stretch it to the point of declaring that it was just a figure of speech.

Darwin himself, in his day, was unable to fight free of the

[2] F. Engels, Letter to P. L. Lavrov, 12-17 November 1875.
[3] T. R Malthus, *Essay on the Principle of Population,* Book I, Chapter I.

theoretical errors of which he was guilty. It was the classics of Marxism that revealed those errors and pointed them out. Today there is absolutely no justification for accepting the erroneous aspects of the Darwinian theory, those based on Malthus's theory of overpopulation with the inference of a struggle presumably going on within species. And it is all the more inadmissible to represent these erroneous aspects as the cornerstone of Darwinism (as I. I. Schmalhausen, B. M. Zavadovsky, and P. M. Zhukovsky do). Such an approach to Darwin's theory prejudices the creative development of its scientific core.

Even when Darwin's teaching first made its appearance, it became clear at once that its scientific, materialist core, its teaching concerning the evolution of living nature, was antagonistic to the idealism that reigned in biology.

Progressively thinking biologists, both in our country and abroad, saw in Darwinism the only right road to the further development of scientific biology. They took it upon themselves to defend Darwinism against the attacks of the reactionaries, with the Church at their head, and of obscurantists in science, such as Bateson.

Eminent biologists, like V. O. Kovalevsky, I. I. Mechnikov, V. M. Sechenov, and particularly K. A. Timiryazev, defended and developed Darwinism with all the passion of true scientists.

K. A. Timiryazev, that great investigator, saw distinctly that only on the basis of Darwinism could the science of the life of plants and animals develop successfully, that only by further developing Darwinism and raising it to new heights was biological science capable of helping the tiller of the soil to obtain two ears of corn where only one grows today.

Darwinism as presented by Darwin contradicted idealistic philosophy, and this contradiction grew deeper with the development of its materialist teaching. Reactionary biologists have therefore done everything in their power to empty Darwinism of its materialist elements. The individual voices of progressive biologists like K. A. Timiryazev were drowned by the chorus of the anti-Darwinists, the reactionary biologists the world over.

In the post-Darwinian period the overwhelming majority of biologists—far from further developing Darwin's teaching—did all they could to debase Darwinism, to smother its scientific foundation. The most glaring manifestation of such debasement of Darwinism is to be found in the teachings of Weismann, Mendel, and Morgan, the founders of modern reactionary genetics.

3. TWO WORLDS—TWO IDEOLOGIES IN BIOLOGY

WEISMANNISM, followed by Mendelism-Morganism, which made its appearance at the beginning of this century, was primarily directed against the materialist foundations of Darwin's theory of evolution.

Weismann named his conception Neo-Darwinism, but, in fact, it was a complete denial of the materialist aspects of Darwinism. It insinuated idealism and metaphysics into biology.

The materialist theory of the evolution of living nature involves recognition of the necessity of hereditary transmission of individual characteristics acquired by the organism under the conditions of its life; it is unthinkable without recognition of the inheritance of acquired characters. Weismann, however, set out to refute this materialist proposition. In his *Lectures on Evolutionary Theory,* he asserts that " not only is there no proof of such a form of heredity, but it is inconceivable theoretically ".[4] Referring to earlier statements of his in a similar vein, he declares that " thus war was declared against Lamarck's principle of the direct effect of use and disuse, and, indeed, that marked the beginning of the struggle which is going on to this day, the struggle between the Neo-Lamarckians and the Neo-Darwinians, as the contending parties are called ".

Weismann, as we see, speaks of having declared war against Lamarck's principle; but it is easy enough to see that he declared war against that without which there is no materialist theory of evolution, that under the guise of "Neo-Darwinism" he declared war against the materialist foundations of Darwinism.

Weismann denied the inheritability of acquired characters and elaborated the idea of a special hereditary substance to be sought for in the nucleus. " The sought for bearer of heredity ", he stated, " is contained in the chromosome material." The chromosomes, he said, contain units, each of which " determines a definite part of the organism in its appearance and final form ".

Weismann asserts that there are " two great categories of living material: the hereditary substance, or idioplasm, and the ' nutrient substance ', or trophoplasm ". And he goes on to declare that the bearers of the hereditary substance, " the chromosomes, represent a separate world, as it were ", a world independent of the organism and its conditions of life.

[4] All quotations from Weismann are retranslations from the 1905 Russian edition of *Lectures on Evolutionary Theory—IV*.

In Weismann's opinion the living body is but a nutritive soil for the hereditary substance, which is immortal and never generated again.

Thus, he asserts, " the germ-plasm is never generated again; it only grows and multiplies continually, handed down from generation to generation. . . . Looked at only from the point of view of propagation, the germ-cells are the most important element in the individual specimen, for they alone preserve the species, whereas the body is reduced practically to the status of mere breeding ground for the germ-cells, the place in which they form and, under favourable conditions, feed, multiply, and ripen ". The living body and its cells, according to Weismann, are but the *container and nutritive medium* of the hereditary substance; they themselves can never produce the latter, they " can never bring forth germ-cells ".

Weismann thus endows the mythical hereditary substance with the property of continued existence; it is a substance which does not itself develop and at the same time determines the development of the mortal body.

Further: " . . . the hereditary substance of the germ-cell, *prior* to the reduction division, potentially contains all the elements of the body ". And although Weismann does state that " in the germ-plasm there is no determinant of a ' hooked nose ' just as there is no determinant of the wing of a butterfly with all its parts and particles ", he goes on to emphasise that, nevertheless, the germ-plasm ". . . contains a certain number of determinants which successively determine the development of an entire group of cells in all its stages, leading to the formation of the nose in such a mode as to result in a hooked nose, exactly in the same way as the wing of a butterfly, with all its little veins, cells, form of scales, and pigment deposits, comes into being by the successive action of multitudinous determinants upon the course of the proliferation of the cells ".

Hence, according to Weismann, the hereditary substance produces no new forms, does *not* develop with the development of the individual, and is *not* subject to any dependent changes.

An immortal hereditary substance, independent of the qualitative features attending the development of the living body, directing the mortal body, but not produced by the latter—that is Weismann's frankly idealistic, essentially mystical conception, which he disguised as " Neo-Darwinism ".

Weismann's conception has been fully accepted and, we might say, carried further by the Mendelists-Morganists.

Morgan, Johannsen, and other pillars of Mendelism-Morganism, declared from the outset that they intended to investigate the phenomena of heredity independently of the Darwinian theory of evolution. Johannsen, for example, wrote in his principal work: ". . . one of the major aims of our research was to put an end to the harmful dependence of the heredity theories on speculations in the field of evolution ".[5] The purpose of the Morganists in making such declarations was to wind up their investigations by assertions which in the final analysis denied evolution in living nature, or recognised it as a process of purely quantitative changes.

As noted above, the controversy between the materialist and the idealist outlook in biological science has been going on throughout its history.

In the present epoch of struggle between two worlds the two opposing and antagonistic trends penetrating the foundations of nearly all branches of biology are particularly sharply defined.

Socialist agriculture, the collective and State farming system, has given rise to a Soviet biological science, founded by Michurin—a science new in principle, developing in close union with agronomic practice, as agronomic biology.

The foundations of Soviet agro-biological science were laid by Michurin and Williams, who generalised and developed the best of what science and practice had accumulated in the past. Their work has enriched our knowledge of the nature of plants and soils, our knowledge of agriculture, with much that is new in principle.

Close contact between science and the practice of collective farms and State farms creates inexhaustible opportunities for the development of theoretical knowledge, enabling us to learn ever more and more about the nature of living bodies and the soil.

It is no exaggeration to state that Morgan's feeble metaphysical " science " concerning the nature of living bodies can stand no comparison with our effective Michurinist agro-biological science.

The new vigorous trend in biology, or more truly the new Soviet biology, agro-biology, has met with strong opposition on the part of representatives of reactionary biology abroad, as well as of some scientists in our country.

The representatives of reactionary biological science—Neo-Darwinians, Weismannists, or—which is the same—Mendelist-Morganists, uphold the so-called chromosome theory of heredity.

Following Weismann, the Mendelist-Morganists contend that the

[5] Retranslated from the Russian.—*Tr.*

chromosomes contain a special "hereditary substance" which resides in the body of the organism as if in a case and is transmitted to coming generations irrespective of the qualitative features of the body and its conditions of life. The conclusion drawn from this conception is that new tendencies and characteristics acquired by the organism under the influence of the conditions of its life and development are not inherited and can have no evolutionary significance.

According to this theory, characters acquired by vegetable and animal organisms cannot be handed down, are *not inherited.*

The Mendelist-Morganist theory does not include in the scientific concept "living body" the conditions of the body's life. To the Morganists, environment is only the background—indispensable, they admit—for the manifestation and operation of the various characteristics of the living body, in accordance with its heredity. They therefore hold that qualitative variations in the heredity (nature) of living bodies are entirely independent of the environment, of the conditions of life.

The representatives of Neo-Darwinism, the Mendelist-Morganists, hold that the efforts of investigators to regulate the heredity of organisms by changes in the conditions of life of these organisms are utterly unscientific. They therefore call the Michurin trend in agro-biology Neo-Lamarckian, which, in their opinion, is absolutely faulty and unscientific.

Actually, it is the other way round.

First, the well-known Lamarckian propositions, which recognise the active role of external conditions in the formation of the living body and the heredity of acquired characters, unlike the metaphysics of Neo-Darwinism (or Weismannism), are by no means faulty. On the contrary, they are quite true and scientific.

Secondly, the Michurin trend cannot be called either Neo-Lamarckian or Neo-Darwinian. It is creative Soviet Darwinism, rejecting the errors of either and free from the defects of the Darwinian theory in so far as it included Malthus's erroneous ideas.

Furthermore, it cannot be denied that in the controversy that flared up between the Weismannists and Lamarckians in the beginning of the twentieth century, the Lamarckians were closer to the truth; for they defended the interests of science, whereas the Weismannists were at loggerheads with science and prone to indulge in mysticism.

The true ideological content of Morgan's genetics has been well

revealed (to the discomfiture of our geneticists) by the physicist Erwin Schroedinger. In his book, *What Is Life? The Physical Aspect of the Living Cell,* he draws some philosophical conclusions from Weismann's chromosome theory, of which he speaks very approvingly. Here is his main conclusion: ". . . the personal self equals the omni-present, all-comprehending, eternal self." Schroedinger regards this conclusion as " the closest a biologist can get to proving God and immortality at one stroke ".

We, the representatives of the Soviet Michurin trend, contend that inheritance of characters acquired by plants and animals in the process of their development is possible and necessary. Ivan Vladimirovich Michurin mastered these possibilities in his experiments and practical activities. The most important point is that Michurin's teaching, expounded in his works, shows every biologist the way to regulating the nature of vegetable and animal organisms, the way of altering it in a direction required for practical purposes by regulating the conditions of life, i.e., by physiological means.

A sharp controversy, which has divided biologists into two irreconcilable camps, has thus flared up over the old question: is it possible for features and characteristics acquired by vegetable and animal organisms in the course of their life to be inherited? In other words, whether qualitative variations of the nature of vegetable and animal organisms depend on the conditions of life which act upon the living body, upon the organism.

The Michurin teaching, which is in essence materialist and dialectical, proves by facts that such dependence does exist.

The Mendel-Morgan teaching, which in essence is metaphysical and idealist, denies the existence of such dependence, though it can cite no evidence to prove its point.

4. THE SCHOLASTICISM OF MENDELISM-MORGANISM

THE chromosome theory is based on Weismann's absurd proposition regarding the continuity of the germ-plasm and its independence of the soma, a proposition which K. A. Timiryazev already condemned. In line with Weismann, the Morganist-Mendelists take it for granted that parents are genetically not the progenitors of their offspring. Parents and children, according to their teaching, are brothers or sisters.

Furthermore, neither parents nor children are really themselves. All they are is by-products of the inexhaustible and immortal germ-

plasm. Variations in the latter are absolutely independent of its by-product, that is, of the body of the organism.

Let us turn to the Encyclopædia where we naturally may expect to find the quintessence of the question under discussion.

In the 1945 edition of the *Encyclopædia Americana,* T. H. Morgan, one of the founders of the chromosome theory, writes in the article entitled " Heredity ": " The germ-cells become later the essential parts of the ovary and testis respectively. In origin, therefore, *they are independent of the rest of the body and have never been a constituent part of it. . . . Evolution is germinal in origin and not somatic as had been earlier taught.* [My emphasis—T. L.] This idea of the origin of new characters is held almost universally today by biologists."

The same idea differently worded is propounded in the same *Encyclopædia Americana* by Professor Castle in the article on " Genetics ". After stating that usually the organism develops from a fertilised egg, Castle goes on to set forth the " scientific " foundations of genetics as follows:

" In reality the parent does not produce the child nor even the reproductive cell which functions in its origin. The parent is himself merely a by-product of the fertilised egg (or zygote) out of which he arose. The direct product of the zygote is other reproductive cells, similar to those from which it arose. . . . Hence heredity (that is, the resemblance between parent and child) depends upon the close connection between the reproductive cells which formed the parent and those which formed the child, one being the immediate and direct product of the other. This principle of the 'continuity of the germinal substance' (reproductive cell material) is one of the foundation principles of genetics. It shows why body changes produced in a parent by environmental influences are not inherited by the offspring. It is because offspring are not the product of the parent's body but only of the germinal substance which that body harbours. . . . To August Weismann belongs the credit for first making this clear. He may thus be regarded as one of the founders of genetics."

It is clear to us that the foundation principles of Mendelism-Morganism are false. They do not reflect the actuality of living nature and are an example of metaphysics and idealism.

Because this is so obvious, the Mendelist-Morganists of the Soviet Union, though actually fully sharing the principles of Mendelism-Morganism, often conceal them shamefacedly, veil

them, disguise their metaphysics and idealism with verbal trimmings. They do this because of their fear of being ridiculed by Soviet readers and audiences firm in the knowledge that the germs of organisms, or the sexual cells, are a result of the vital activity of the parent organisms.

It is only when no mention is made of the fundamentals of Mendelism-Morganism that persons having no detailed knowledge of the life and development of plants and animals can be led to think of the chromosome theory of heredity as a neat system, as in some degree corresponding to the truth. But once we accept the absolutely true and generally known proposition that the reproductive cells, or the germs, of new organisms are produced by the organism, by its body, and not by the very same reproductive cell from which the given, already mature, organism arose, nothing is left of the "neat" chromosome theory of heredity.

Naturally, what has been said above does not imply that we deny the biological role and significance of chromosomes in the development of the cells and of the organism. But it is not at all the role which the Morganists attribute to the chromosomes.

Plenty of examples can be cited to show that our home-grown Mendelist-Morganists accept in its entirety the chromosome theory of heredity, its Weismannist foundations and idealistic conclusions.

Academician N. K. Koltzov, for example, asserts: "Chemically, the genoneme with its genes remains unchanged in the course of the entire ovogenesis and is not subject to metabolism—oxidising and restorative processes."[6] This assertion, which no literate biologist can accept, denies the existence of metabolism in a section of the living developing cells. It must be obvious to everyone that N. K. Koltzov's conclusion is fully in line with the Weismannist and Morganist idealist metaphysics.

N. K. Koltzov's wrong assertion dates back to 1938. It has long since been exposed by the Michurinists, and it would, perhaps, not have been worth while going back to the past if not for the fact that the Morganists persist in holding on to their anti-scientific positions to this day.

We can find further proof of this by turning once more to Schroedinger's book mentioned above. Schroedinger says in substance the same things as Koltzov. Since he shares the idealistic conception of the Morganists, he also asserts that there exists an

[6] N. K. Koltzov, "The Structure of Chromosomes and Metabolism in Them", *Journal of Biology* (Russian), Vol. VII, Issue No. 1, 1938, p. 42.

"*hereditary substance*" which is "*capable of withstanding for long periods the disturbing influence of heat motion. . . .*" [My emphasis —T. L.]

The Russian translator of Schroedinger's book, A. A. Malinovsky (a scientific worker in N. P. Dubinin's laboratory), in his "Postscript" to the said book, subscribes—and with good reason—to Haldane's opinion, linking Schroedinger's idea with N. K. Koltzov's views.

In that "Postscript", written in 1947, Malinovsky says: "The view accepted by Schroedinger, according to which the chromosome is a gigantic molecule (Schroedinger's 'aperiodic crystal'), was first put forward by the Soviet biologist, Prof. N. K. Koltzov, and not by Delbrück, with whose name Schroedinger associates this conception."

There is no point, in this case, in going into the question of who is entitled to claim credit for the authorship of this scholastic view. A more important point is the high appreciation of Schroedinger's book by one of our home-grown Morganists, A. A. Malinovsky.

Here are a few samples of the praise he showers on this book: "In a fascinating form, accessible both to the physicist and the biologist, Schroedinger reveals to the reader a new trend rapidly developing in science, a trend largely combining the methods of physics and of biology."

"Strictly speaking, Schroedinger's book represents the first coherent results of this trend. . . . Schroedinger makes a big contribution of his own to this new trend in the science of life, and this quite justifies the enthusiastic opinions voiced about his book in the foreign scientific press."

Since I am no physicist, I shall say nothing concerning the methods of physics which Schroedinger combines with biology. As for the biology in Schroedinger's book, it is Morganist pure and simple and this, in fact, is what makes Malinovsky go into raptures over it.

The enthusiastic praise of Schroedinger's book in Malinovsky's "Postscript" speaks eloquently enough of our Morganists' idealistic views and positions.

M. M. Zavadovsky, Professor of Biology in the University of Moscow, writes in an article entitled "The Creative Road of Thomas Hunt Morgan": "Weismann's ideas found a wide response among biologists, and many of them have taken the road suggested

by that highly gifted investigator . . . Thomas Hunt Morgan was one of those who highly appreciated the main content of Weismann's ideas."[7]

Now what "main content" is meant here?

What is meant is an idea of prime importance to Weismann and all Mendelist-Morganists, including Prof. M. M. Zavadovsky. The latter formulates that idea as follows: "What came first, the hen's egg or the hen? And", writes Professor Zavadovsky, "to the question posed thus sharply Weismann gave an explicit, categorical reply: the egg."

It is obvious to anyone that both the question and the answer which Professor Zavadovsky, following Weismann, gives are nothing but a revival, and a belated one at that, of old scholasticism.

In 1947 Professor M. M. Zavadovsky repeats and defends the ideas he set forth in 1931 in his work *Dynamics of Development of Organisms*. There M. M. Zavadovsky considered it necessary to "firmly join with Nussbaum who maintains that sexual products do not develop from the maternal organism, but from the same source as the latter", that "the seminal corpuscles and eggs do not originate in the parent organism, but have a common origin with the latter". And in his "General Conclusion" Professor Zavadovsky wrote: "Analysis leads us to the conclusion that the cells of the germ track cannot be regarded as products of somatic tissue. The germ cells and the cells of the soma should be regarded not as daughter and parent generations, but as twin sisters, of which one (the soma) is the feeder, protector, and guardian of the other."

The geneticist, N. P. Dubinin, Professor of Biology, wrote in his article, "Genetics and Neo-Lamarckism": "Genetics quite rightly divides the organism into two distinct sections—the hereditary plasm and the soma. More, this division is one of its foundation principles, one of its major generalisations."[8]

We need not continue the list of such authors as M. M. Zavadovsky and N. P. Dubinin, who frankly expound the ABC of the Morganist system. In college text-books on genetics this ABC is called the "Mendelian laws" (dominance, division, purity of gametes, etc.). An example of how uncritically our Mendelist-Morganists accept idealistic genetics is the fact that the standard text-book on genetics in many of our colleges has until quite recently been a translated American text-book, by Sinnott and Dunn.

[7] *Bulletin of the Moscow Society of Naturalists* (Russian), Vol. LII, Issue No. 3, 1947, p. 86.

[8] *Natural Science and Marxism* (Russian), 1929, No. 4, p. 83.

Fully in line with the main theses of that text-book, Prof. N. P. Dubinin wrote in that same article of his ("Genetics and Neo-Lamarckism"): "Thus the facts of modern genetics rule out any recognition of the 'foundation of foundations' of Lamarckism—*the idea that acquired characters are inherited.*"[9] [My emphasis—T. L.]

The Mendelist-Morganists have thus thrown overboard one of the greatest acquisitions in the history of biological science—the principle of the inheritance of acquired characters.

To the materialist teaching that it is possible for plants and animals to inherit individual variations of characters acquired under the influence of conditions of life, Mendelism-Morganism opposes an idealistic assertion, dividing the living body into two separate substances: the mortal body (or soma) and an immortal hereditary substance, germ-plasm. It is further categorically maintained that changes in the soma, i.e., in the living body, have no effect whatever upon the hereditary substance.

5. THE IDEA OF UNKNOWABILITY IN THE TEACHING ON "HEREDITARY SUBSTANCE"

MENDELISM-MORGANISM endows the postulated mythical "hereditary substance" with an indefinite character of variation. Mutations, i.e., changes of the "hereditary substance", are supposed to have no definite tendency. This assertion of the Morganists is logically connected with the underlying basis of Mendelism-Morganism—the principle that the hereditary substance is independent of the living body and its conditions of life.

The Morganist-Mendelists, who proclaim that hereditary alterations, or "mutations" as they are called, are "indefinite", presume that such alterations *cannot as a matter of principle be predicted.* We have here a peculiar conception of unknowability; its name is idealism in biology.

The assertion that variation is "indefinite" raises a barrier to scientific foresight, thereby disarming practical agriculture.

Proceeding from the unscientific and reactionary Morganist teaching concerning "indefinite variation", the head of the chair of Darwinism at the University of Moscow, Academician I. I. Schmalhausen, asserts in his *Factors of Evolution* that hereditary variation, in its specific features, does not depend on the conditions of life and therefore has no definite tendency.

[9] Ibid., p. 81.

"Factors unassimilated by the organism", writes Schmalhausen, "if they reach the organism at all and influence it, can have but an indefinite effect. . . . Such influence can only be indefinite. Consequently, all new alterations in the organism, which as yet have no past history, will be indefinite. This category of alterations will include, however, not only mutations as new 'hereditary' changes, but any new (i.e., appearing for the first time) modification."[10]

On a preceding page in the same book Schmalhausen writes: "In the development of any individual environmental factors perform, in the main, only the role of agents liberating the course of certain form-producing processes and the conditions which make it possible to consummate their realisation."[11]

This formalistic, autonomistic theory of a "liberating cause" in which the role of external conditions is reduced to the realisation of an autonomous process, has long been demolished by the advance of progressive science; it has been exposed by materialism as unscientific, as in essence idealistic.

Schmalhausen and others among our home-grown followers of imported Morganism claim that what they are asserting Darwin said before them. In proclaiming the "indefiniteness of variation", they invoke Darwin's statements on the subject. Darwin indeed spoke of "indefinite variation". But that was due to the *limitations* of selection practice in his days. Darwin was aware of that himself and wrote that there were at that time no means of explaining the causes or nature of variation in organic beings. That, he said, was an obscure matter.

The Mendelist-Morganists cling to everything that is obsolete and wrong in Darwin's teaching, at the same time discarding its living materialist core.

In our Socialist country, the teaching of the great transformer of nature, I. V. Michurin, has created a fundamentally new basis for directing the variability of living organisms.

Michurin himself and his followers have obtained and are obtaining directed hereditary changes in vegetable organisms literally in immense quantities. Yet Schmalhausen still asserts that:

"The appearance of individual mutations is by all indications a case of chance phenomena. We can neither predict nor deliberately induce this or that mutation. So far it has been found impossible to

[10] Acad. I. I. Schmalhausen, *Factors of Evolution* (Russian). Acad. of Sciences of the U.S.S.R., 1946, pp. 12-13.
[11] Ibid., p. 11.

establish any reasonable connection between the quality of mutation and definite changes in the factors of the environment."[12]

On the basis of the Morganist conception of mutations, Schmalhausen has formulated the theory of so-called " stabilising selection " —a theory profoundly wrong ideologically and having a disarming effect upon practical activity. According to Schmalhausen, the formation of breeds and strains proceeds—presumably inevitably—in a receding curve: the formation of breeds and strains, stormy at the dawn of civilisation, increasingly expends its " reserve of mutations " and gradually recedes. " Both the formation of breeds of domestic animals and the formation of strains of cultivated plants ", writes Schmalhausen, " proceeded with such exceptional speed mainly, apparently, because of the previously accumulated reserve of variability. Further strictly directed selection is slower. . . ."[13]

Schmalhausen's assertion and his entire conception of " stabilising selection " follow the Morgan line.

As we know, Michurin, in the course of his lifetime, produced more than three hundred new strains of plants. Many of them were produced without sexual hybridisation, and all of them were the result of strictly directed selection, including systematic training. It is an insult to progressive science to assert—in face of these facts and subsequent achievements of followers of Michurin's teaching—that strictly directed selection must progressively recede.

Schmalhausen obviously finds that Michurin's facts do not fit in with his theory of " stabilising selection ". In his book, *Factors of Evolution*, he gets out of the difficulty by making no mention of these works of Michurin or of the very existence of Michurin as a scientist. Schmalhausen has written a bulky volume on factors of evolution without ever once mentioning—not even in his bibliography—either K. A. Timiryazev or I. V. Michurin. Yet Timiryazev bequeathed to Soviet science a remarkable theoretical work bearing practically the same title: *Factors of Organic Evolution*. As for Michurin and the Michurinists, they have put the factors of evolution to work for agriculture, revealed new factors and given us a deeper understanding of the old ones.

Schmalhausen has " forgotten " the Soviet advanced scientists, the founders of Soviet biological science. But at the same time he quotes profusely and repeatedly statements of big and small foreign and home-grown representatives of Morgan's metaphysics and

[12] Ibid., p. 68.
[13] Ibid., pp. 214-215.

leaders of reactionary biology. That is the style of Academician Schmalhausen, who calls himself a "Darwinist". Yet at a meeting of the Faculty of Biology at the University of Moscow his book was recommended as a masterpiece in the creative development of Darwinism. The book has been given a high rating by the deans of the Faculties of Biology at the Universities of Moscow and Leningrad; it has been praised by I. Polyakov, Professor of Darwinism at the University of Kharkov, by the Pro-Rector of the University of Leningrad, Y. Polyansky, by the member of our Academy, B. Zavadovsky, and by other Morganists who sometimes pose as orthodox Darwinists.

6. THE STERILITY OF MORGANISM-MENDELISM

THE Morganist-Weismannists, i.e., the adherents of the chromosome theory of heredity, have repeatedly asserted—without grounds whatever and often in a slanderous manner—that I, as President of the Academy of Agricultural Sciences, have used my office in the interests of the Michurin trend in science, which I share, to suppress the other trend, the one opposed to Michurin's.

Unfortunately, it has so far been exactly the other way round, and it is of that that I, as President of the All-Union Academy of Agricultural Sciences, may and should be accused. I have been wanting in strength and ability to make proper use of my official position to create conditions for the more extensive development of the Michurin trend in the various divisions of biological science, and to restrict, if only somewhat, the scholastics and metaphysicians of the opposite trend. As a matter of fact, therefore, the trend so far suppressed—suppressed by the Morganists—happens to be the one which the President represents, namely, the Michurin trend.

We, the Michurinists, must squarely admit that we have hitherto proved unable to make the most of the splendid possibilities created in our country by the Party and the Government for the complete exposure of the Morganist metaphysics, which is in its entirety an importation from foreign reactionary biology hostile to us. It is now up to the Academy, to which a large number of Michurinists have just been elected, to tackle this major task. This will be of considerable importance in the matter of training forces and providing more scientific aid to collective farms and state farms.

Morganism-Mendelism (the chromosome theory of heredity) is to this day taught, in a number of versions, in all colleges of biology

and agronomy, whereas the study of Michurin genetics has in fact not been introduced at all. In the higher official scientific circles of biologists, too, the followers of the teaching of Michurin and Williams have often found themselves in the minority. They were a minority in the Lenin All-Union Academy of Agricultural Sciences, too. But the condition in the Academy has now sharply changed thanks to the interest taken in it by the Party, the Government, and Comrade Stalin personally. A considerable number of Michurinists have been elected members and corresponding members of our Academy, and more will be added shortly, at the coming elections. This will create a new situation in the Academy and new opportunities for the further development of the Michurin teaching.

The assertion that the chromosome theory of heredity, with its underlying metaphysics and idealism, has hitherto been suppressed, is entirely wrong. The very opposite is the truth.

In our country the Morganist cytogeneticists find themselves confronted by the practical effectiveness of the Michurin trend in agrobiological science.

Aware of the practical worthlessness of the theoretical postulates of their metaphysical " science ", and reluctant to give them up and to accept the vigorous Michurin trend, the Morganists have bent all their efforts to check the development of the Michurin trend which is inherently opposed to their pseudo-science.

It is a calumny to assert that somebody has been preventing the cytogenetic trend in biological science from associating itself with practical agriculture in our country. There is no truth whatever in the assertions to the effect that " the right to the practical application of the fruits of their labours has been a monopoly of Academician Lysenko and his followers ".

The Ministry of Agriculture might tell us exactly what the cytogeneticists have offered for practical application, and, if there have been such offers, whether they were accepted or rejected.

The Ministry of Agriculture might also tell us which of its scientific-research institutes (to say nothing of colleges) have not engaged in cytogenetics in general and, particularly, in the polyploidy of plants obtained by the application of colchicine.

I know that many institutes have been engaged and are engaged in this sort of activity which, in my view, is little productive. More, the Ministry of Agriculture set up a special institution, headed by A. R. Zhebrak, to study questions of polyploidy. I think that this

institution, though it has for some years done nothing besides its work on polyploidy, has produced literally nothing of practical value.

Here is one example which might be cited to show how useless is the practical and theoretical programme of our domestic Morganist cytogeneticists.

Professor of Genetics, N. P. Dubinin, Corresponding Member of the Academy of Sciences of the U.S.S.R., who is regarded by our Morganists as the most eminent among them, has worked for many years to establish the differences in the cell nuclei of fruit flies in urban and rural localities.

For the sake of complete clarity, let us mention the following. What Dubinin is investigating is not qualitative alterations—in this case, in the nucleus of the cell—resulting from the action of qualitatively differing conditions of life. What he is studying is not the inheritance of characteristics acquired by fruit flies under the influence of definite conditions of life, but changes, recognisable in the chromosomes, in the make-up of the population of these flies as the result of the simple destruction of a part of them, for one thing, during the war. Dubinin and other Morganists call such destruction " selection ". Such sort of " selection " identical with an ordinary sieve, which has nothing in common with the truly creative role of selection, is the subject of Dubinin's investigations.

His work is entitled: " Structural Variability of Chromosomes in Populations of Urban and Rural Localities."

Here are a few quotations from it:

" During the study of individual populations of *D. funebris* in the work of 1937 the fact was noted that there were noticeable differences as regards concentration of inversions. Tinyakov stressed this phenomenon on the basis of extensive material. However, only the 1944-45 analysis has shown us that these substantial differences are due to the differences of conditions of habitation in town and in countryside.

" The population of Moscow has eight different orders of genes. In the second chromosome there are four orders (one standard and three different inversions). One inversion in the III chromosome and one in IV . . . Inv. II—1 has its limits from 23 C to 31 B. Inv. II—2, from 29 A to 32 B. Inv. II—3, from 32 B to 34 C. Inv. III—1, from 50 A to 56 A. Inv. IV—1, from 67 C to 73 A/B. In the course of 1943-45 the karyotype of 3,315 individuals in the population of Moscow was studied. The population contained immense concentra-

tions of inversions, which proved to be different in various sections of Moscow."[14]

Dubinin went on with his investigations during and after the war and studied the problem of the fruit flies in the city of Voronezh and its environs. He writes:

" The destruction of industrial centres during the war upset the normal conditions of life. The drosophila populations found themselves in severe conditions of existence which, possibly, surpassed the severity of wintering in rural localities. It would be of profound interest to study the influence of the changes in the conditions of existence caused by the war upon the karyotypical structure of urban populations. In the spring of 1945 we studied populations from the city of Voronezh, one of those that suffered the worst destruction as the result of the German invasion. Among 225 individuals only two flies were found to be heterozygotal for inversion II—2 (0.88 per cent). Thus the concentration of inversions in this large city proved to be lower than in rural localities. We see here the disastrous action of natural selection upon the karyotypical structure of the population."[15]

Dubinin, as we see, writes so that on the surface his work may appear to some to be even scientific. As a matter of fact, this was one of the main works on the basis of which Dubinin was elected Corresponding Member of the Academy of Sciences of the U.S.S.R.

But if we were to put it all in plainer terms, stripping it of the pseudo-scientific verbiage and replacing the Morganist jargon with ordinary Russian words, we would arrive at the following:

As the result of many years of effort Dubinin " enriched " science with the " discovery " that during the war there occurred among the fruit-fly population of the city of Voronezh and its environs an increase in the percentage of flies with certain chromosome structures and a decrease in the percentage of flies with other chromosome structures (in the Morganist jargon that is called " concentration of inversions " II—2).

Dubinin is not content with these " highly valuable " discoveries from the theoretical and practical standpoint, which he made during the war. He sets himself further tasks for the period of recovery. He writes:

" It will be very interesting to study in the course of several coming years the restoration of the karyotypical structure of the

[14] *Reports of the Academy of Sciences of the U.S.S.R.*, 1946, Vol. LI, No. 2, p. 152.

[15] Ibid., p. 153.

urban population in connection with the restoration of normal conditions of life."

That is typical of the Morganists' "contribution" to science and practical activity before the war and during the war, and such are the vistas of the Morganist "science" for the period of recovery!

7. MICHURIN'S TEACHING, FOUNDATION OF SCIENTIFIC BIOLOGY

CONTRARY to Mendelism-Morganism, with its assertion that the causes of variation in the nature of organisms are unknowable and its denial of the possibility of directed changes in the nature of plants and animals, I. V. Michurin's motto was: "We must not wait for favours from Nature; our task is to wrest them from her."

His studies and investigations led I. V. Michurin to the following important conclusion: "It is possible, with man's intervention, to *force* any form of animal or plant to *change more quickly and in a direction desirable to man.* There opens before man a broad field of activity most useful for him."[16]

The Michurin teaching flatly rejects the fundamental principle of Mendelism-Morganism that heredity is completely independent of the plants' or animals' conditions of life. The Michurin teaching does not recognise the existence in the organism of a separate hereditary substance which is independent of the body. Changes in the heredity of an organism or in the heredity of any part of its body are the result of changes in the living body itself. And changes of the living body occur as the result of departure from the normal in the type of assimilation and dissimilation, of departure from the normal in the type of metabolism. Changes in organisms or in their separate organs or characters may not always, or not fully, be transmitted to the offspring, but changed germs of newly generated organisms always occur only as the result of changes in the body of the parent organism as the result of direct or indirect action of the conditions of life upon the development of the organism or its separate parts, among them the sexual or vegetative germs. Changes in heredity, acquisition of new characters and their augmentation and accumulation in successive generations are always determined by the organism's conditions of life. Heredity changes and increases in complexity as the result of the accumulation of new characters and properties acquired by organisms in successive generations.

The organism and the conditions required for its life are an in-

[16] I. V. Michurin, *Works,* Vol. IV, p. 72 (Russian).

separable unity. Different living bodies require different environmental conditions for their development. By studying these requirements we come to know the qualitative features of the nature of organisms, the qualitative features of heredity. Heredity is *the property of a living body to require definite conditions for its life and development and to respond in a definite way to various conditions.*

Knowledge of the natural requirements of an organism and its response to external conditions makes it possible to direct the life and development of the organism. By regulating the conditions of life and development of plants and animals we can penetrate their nature ever more deeply and thus establish what are the means of changing it in the required direction. Once we know the means of regulating development we can change the heredity of organisms in a definite direction.

Each living body builds itself out of the conditions of its environment in its own fashion, according to its heredity. That is why different organisms live and develop in the same environment. As a rule, each given generation of a plant or animal develops largely in the same way as its predecessors, particularly its close predecessors. *Reproduction of beings similar to itself is the general characteristic of every living body.*

When an organism finds in its environment the conditions suitable to its heredity, its development proceeds in the same way as it proceeded in previous generations. When, however, organisms do not find the conditions they require and are forced to assimilate environmental conditions which, to some degree or other, do not accord with their nature, then the organisms or parts of their bodies become more or less different from the preceding generation. If the altered section of the body is the starting point for the new generation, the latter will, to some extent or other, differ from the preceding generations in its requirements and nature.

The cause of changes in the nature of a living body is a change in the type of assimilation, in the type of metabolism. For example, the vernalisation (yarovisation) of spring cereals does not require lowered temperatures. Normally it proceeds in temperatures such as obtain in the spring and summer in the fields. But by using lower temperature conditions in the vernalisation of spring cereals it is possible, after two or three generations, to turn them into winter cereals. And winter cereals require lowered temperatures for their vernalisation. Here is a concrete example showing how a new

requirement is induced in the offspring of the plants under discussion—the requirement for lowered temperatures as a condition for vernalisation.

Sexual cells and any other cells through which organisms propagate are produced as the result of the development of the whole organism, by means of metabolism and transformation. The stages in the evolution of an organism are accumulated, as it were, in the cells from which the new generation originates.

We may therefore say that to the extent that in the new generation the body of an organism (a plant, say) is built anew there also develop all its characters, including heredity.

In one and the same organism the development of various cells and their separate parts, the development of individual processes, requires different external conditions.

Besides, these conditions are assimilated in different ways. It should be stressed that in this case we mean by *external* that which *is assimilated,* and by *internal* that which *assimilates.*

The life of an organism proceeds through innumerable correlated processes and transformations. The food that enters the organism from the external environment undergoes a series of transformations whereby it is assimilated by the living body, changing from external to internal. This internal, since it is living matter, enters into metabolic relations with the substances of other cells and particles of the body, feeding them and thus becoming external with regard to them.

Two kinds of qualitative changes are observed in the development of vegetable organisms.

1. Changes connected with the process of the realisation of the individual cycle of development, when natural requirements, i.e., heredity, are normally met by the *corresponding external conditions.* The result is a body of the same breed and heredity as the preceding generations.

2. Changes of nature, i.e., changes in heredity. Such changes are also the result of individual development, but deviating from the normal, usual process. Changes in heredity are as a rule the result of the organism's development *under external conditions which, to some extent or other, do not correspond to the natural requirements of the given organic form.*

Changes in the conditions of life bring about changes in the type of development of vegetable organisms. A changed type of development is thus the primary cause of changes in heredity. All organisms

which cannot change in accordance with the changed conditions of life do not survive, leave no progeny.

Organisms, and hence also their nature, are created only in the process of evolution. Of course, a living body may undergo an alteration also outside the evolutionary process (a burn, a break in joints, tearing of roots, etc.), but such alterations will not be characteristic or necessary for the vital process.

Numerous facts go to show that changes in various sections of the body of a vegetable or animal organism are not fixed by the reproductive cells with the same frequency or to the same extent.

This is explained by the fact that the process of development of each organ, of each particle of the living body, requires relatively definite external conditions. These conditions are selected from the environment by the development of each organ and minutest part of an organ. Therefore, if a section of the body of a vegetable organism is forced to assimilate conditions relatively unusual for it and as a result undergoes alteration and becomes different from the analogous section of the body in the preceding generation, the substances which it sends forth to neighbouring cells may not be selected by the latter, may not be joined into the further chain of corresponding processes. Of course, there will still be a connection between the altered section of the vegetable organism and the other sections of the body, for otherwise it could not exist at all; but this connection may not be fully reciprocal. The altered section of the body will be receiving this or that food from the neighbouring sections; but it will not be able to give away its own specific substances, because the neighbouring sections will refuse to select them.

This explains the frequently observed phenomenon when altered organs, characters, or properties of an organism do not appear in the progeny. But the altered sections of the body of the parent organism always possess an altered heredity. Horticulturists have long known these facts. An altered twig or bud of a fruit tree or the eye (bud) of a potato tuber cannot as a rule influence the heredity of the offspring of the given tree or tuber which are not directly generated from the altered sections of the parent organism. If, however, the altered section is cut away and grown separately as an independent plant, the latter, as a rule, will possess a changed heredity, the one that characterised the altered section of the parent body.

The extent of hereditary transmission of alterations depends on the extent to which the substances of the altered section of the body

join in the process which leads to the formation of reproductive sexual or vegetative cells.

Once we know how the heredity of an organism is built up, we can change it in a definite direction by creating definite conditions at a definite moment in the development of the organism.

Good strains of plants or breeds of animals are always produced by the application of proper methods of cultivation or breeding. No good strains can ever be produced by poor methods of cultivation, and in many cases even good strains will deteriorate under such conditions after a few generations. It is a basic rule in seed growing that plants grown for seed must be tended with the utmost care. They must be provided with conditions meeting the optimum of the hereditary requirements of the given plants. Of well-cultivated plants the very best are selected for seed. That is the way strains of plants are improved in practice. Under poor cultivation, no selection of the best plants for seed will produce the required results. Under poor cultivation all the seeds obtained are poor, and the best among them are still poor.

According to the chromosome theory of heredity, hybrids can only be produced by sexual reproduction. That theory denies the possibility of obtaining vegetative hybrids, for it denies that the conditions of life have any specific influence upon the nature of plants. I. V. Michurin not only recognised the possibility of producing vegetative hybrids, but elaborated the "mentor" method. This method consists in the following: by grafting scions (twigs) of old strains of fruit trees on the branches of a young strain, the latter acquires properties which it lacks, these properties being transmitted to it through the grafted twigs of the old strain. That is why I. V. Michurin called this method "mentor". The stock is also used as a mentor. By this method Michurin produced or improved a number of new good strains.

I. V. Michurin and the Michurinists have found methods of obtaining vegetative hybrids in large quantities.

The vegetative hybrids cogently prove that Michurin's conception of heredity is correct. At the same time they represent an insuperable obstacle to the theory of the Mendelist-Morganists.

When grafted, organisms which have not reached the stage of full formation, i.e., have not completed their cycle of development, will always change their development as compared with the plants which have their own roots. In the union of plants by means of grafting the product is a single organism with varying strains, that of the

stock and that of the scion. By planting the seeds from the stock or the scion it is possible to obtain offspring, individual representatives of which will possess the characteristics not only of the strain from which the seed has been taken, but also of the other with which it has been united by grafting.

Obviously, the scion and the stock could not have exchanged chromosomes of the cell nuclei; yet inherited characters have been transmitted from stock to scion and vice versa. Consequently, *the plastic substances produced by the stock and the scion, just as the chromosomes, and just as any particle of the living body, possess the characters of the strain,* are endowed with definite heredity.

Any character may be transmitted from one strain to another by means of grafting as well as by the sexual method.

The wealth of factual material concerning vegetative transmission of various characters of potatoes, tomatoes, and a number of other plants leads us to the conclusion that vegetative hybrids do not differ in principle from sexual hybrids.

The representatives of Mendel-Morgan genetics are not only unable to obtain alterations of heredity in a definite direction, but categorically deny that it is possible to change heredity so as adequately to meet environmental conditions. The principles of Michurin's teaching, on the other hand, tell us that we can change heredity so as *fully to meet the effect of the action of conditions of life.*

A case in point is the experiments to convert spring forms of bread grains into winter forms, and winter forms into still hardier ones in regions of Siberia, for example, where the winters are severe. These experiments are not only of theoretical interest. They are of considerable practical value for the production of frost-resistant strains. We already have winter forms of wheat obtained from spring forms, which are not inferior, as regards frost-resistance, to the most frost-resistant strains known in practical farming. Some are even superior.

Many experiments show that when an old-established kind of heredity is being eliminated, we do not at once get a fully established, solidified new heredity. In the vast majority of cases what we get is an organism with a plastic nature, which I. V. Michurin called " shaken ".

Vegetable organisms with a " shaken " nature are those in which their conservatism has been eliminated, and their selectivity with regard to external conditions is weakened. Instead of conservative

heredity, such plants preserve, or there appears in them, only a *tendency* to show some preference for certain conditions.

The nature of a vegetable organism may be shaken:

1. By grafting, i.e., by uniting the tissues of plants of different varieties;

2. By bringing external conditions to bear upon them at definite moments, when the organism undergoes this or that process of its development;

3. By cross-breeding, particularly of forms sharply differing in habitat or origin.

The best biologists, first and foremost I. V. Michurin, have devoted a great deal of attention to the practical value of vegetable organisms with shaken heredity. Plastic vegetable forms with unestablished heredity, obtained by any of the enumerated methods, should be further bred from generation to generation in those conditions, the requirement of which, or adaptability to which, we want to induce and perpetuate in the given organisms.

In most vegetable and animal forms new generations develop only after fertilisation—the fusion of female and male reproductive cells. The biological significance of the process of fertilisation is that thereby organisms are produced with dual heredity—maternal and paternal. Dual heredity lends vitality to organisms and widens the range of their adaptability to varying conditions of life.

It is the usefulness of enriching heredity that determines the biological necessity for cross-breeding forms differing from each other even if ever so slightly.

The renovation and strengthening of the vitality of vegetable forms may take place also by the vegetative, asexual method. It is brought about by the living body assimilating new external conditions, conditions unusual for it. In experiments in vegetative hybridisation with the aim of producing spring forms out of winter forms or vice versa, and in a number of other cases of the nature of organisms becoming shaken, we may observe the renovation and strengthening of the vitality of organisms.

By regulating external conditions, the conditions of life, of vegetable organisms, we can change strains in a definite direction and create strains with desirable heredity.

Heredity is the effect of the concentration of the action of external conditions assimilated by the organism in a series of preceding generations.

By means of skilful hybridisation, by the method of sexual con-

jugation of breeds, it is possible at once to unite in one organism that which has been assimilated and solidified in the crossed breeds by many generations. But, according to Michurin's teaching, no hybridisation will produce the desired results, unless the conditions are created which will promote the development of the characters which we want the newly bred or improved strain to inherit.

I have here propounded Michurin's teaching in most general outline. The important point that must be stressed here is that it is absolutely necessary for all Soviet biologists to make a profound study of this teaching. The best way for scientific workers in various departments of biology to master the theoretical depths of the Michurin teaching is to study Michurin's works, to read them over again and again, and to analyse some of them with a view to solving problems of practical importance.

Socialist agriculture stands in need of a developed, profound biological theory which will help us quickly and properly to perfect the methods of cultivating plants and obtaining plentiful and stable crop yields. It stands in need of a profound biological theory which will help workers in agriculture to obtain in a short time the highly productive strains of plants they need to correspond to the high fertility which the collective farmers are creating on their fields.

Unity of theory and practice—that is the right highroad for Soviet science. The Michurin teaching is the one that best embodies this unity in biological science.

In my speeches and writings I have cited numerous examples of the application of the Michurin teaching to solve questions of practical importance in various departments of plant breeding. Here I shall take the liberty to dwell briefly on some questions of animal breeding.

As in the case of vegetable forms, the forming of animals is closely linked with their conditions of life, with the conditions of their environment.

The basis for increasing the productivity of domestic animals, for improving existing breeds and producing new ones, is their food and the conditions in which they are kept. This is particularly important if the effectiveness of cross-breeding is to be heightened. Various breeds of domestic animals have been and are produced by men for various purposes and under various conditions. Each breed therefore requires its own conditions of life, those that contributed to its formation.

The greater the divergences between the biological properties of

a breed and the conditions of life provided for the individual animals, the less will be the economic value of the given breed.

For example, the advantages—from an economic standpoint—of rich pastures and good feeding with succulent and concentrated fodders are smaller in the case of cattle which by nature cannot give much milk than in the case of cattle with high milking capacities. The former breed thus obviously does not, in the economic respect, come up to the conditions provided for it. Such a breed should be improved by cross-breeding so as to adjust it to the conditions of feeding and maintenance.

On the other hand, a breed noted for its milk-yielding properties, when placed in conditions of poor feeding and maintenance, will not only fail to live up to its reputation as a milk producer, but its chances of survival will be diminished. In such cases the conditions of feeding and maintenance should be improved so as to adjust them to the breed.

Our science and practice of animal breeding, in line with the state plan for obtaining produce in the required quantities and of proper quality, must be guided by the principle: *to select and improve breeds in accordance with the conditions of feeding, maintenance and climate, and at the same time to create conditions of feeding and maintenance most suitable to the given breeds.*

The principal method of constantly improving breeds is to select pedigreed animals best suited for the required aim and at the same time to improve the conditions of feeding and maintenance that are most conducive to the development of the animals in the desired direction.

Cross-breeding is a radical and quick method of changing breeds, that is to say, the progeny of the given animals.

In cross-breeding we get, as it were, a union of two breeds evolved by man in the course of a long period of time by creating various conditions of life for the animals. But the nature (heredity) of crosses, particularly in the first generation, is usually unstable, easily responding to the action of the conditions of life, feeding, and maintenance.

Therefore, in cross-breeding it is of especial importance, in choosing a breed for the improvement of a local breed, to bear in mind the conditions of feeding, maintenance, and climate. At the same time, in order to develop the characters and properties which we want to induce by cross-breeding, we must provide conditions of feeding and maintenance conducive to the development of the new

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improving properties; otherwise, we may fail to establish the desired qualities and the breed may even lose some of its good qualities.

I have given an example of the application of the general principles of the Michurin teaching to animal husbandry to show that Soviet Michurin genetics, revealing as it does the general laws of the development of living bodies in order to cope with problems of practical importance, is also applicable to stockbreeding.

When we speak of mastering the teaching of Michurin we also mean the development and deepening of this teaching, the development of scientific biology. That is the line along which we must secure the growth of the forces of our Michurin biologists so as to provide increasing scientific assistance to the collective farms and State farms in coping with the tasks set by the Party and the Government.

8. YOUNG SOVIET BIOLOGISTS SHOULD STUDY THE MICHURIN TEACHING

UNFORTUNATELY, the Michurin teaching is not so far taught in our universities and colleges. We Michurinists are greatly to blame for this. But it will be no mistake to say that it is also the fault of the Ministry of Agriculture and the Ministry of Higher Education.

To this day Morganism-Mendelism is taught in the majority of our universities and colleges in the chairs of genetics and selection, and in many cases also in the chairs of Darwinism, whereas the Michurin teaching, the Michurin trend in science, fostered by the Bolshevik Party and by Soviet reality, remains in the shade.

The same may be said of the position with regard to the training of young scientists. By way of illustration, we shall cite the following. In an article "On Doctors' Theses and the Responsibility of Opponents," printed in issue No. 4 of the *Vestnik Vysshey Shkoly* ("Higher Education Messenger") for 1945, Academician P. M. Zhukovsky, who is the Chairman of the Biology Experts' Commission under the Highest Committee on Academic Degrees, wrote: "A deplorable situation has developed in the matter of theses on genetics. *Theses on genetics are very rare;* they represent, in fact, solitary instances. This is to be explained by the abnormal relations, which have assumed the character of hostility, between the adherents of the chromosome theory of heredity and its opponents. The truth of the matter is that the former somewhat fear the latter, who are very aggressive in their polemics. It would be better to put an end

to this situation. Neither the Party nor the Government forbid the chromosome theory of heredity, and it is freely propounded in universities and colleges. Let the controversy go on." (p. 30.)

Let us first note that P. M. Zhukovsky confirms that the chromosome theory of heredity is freely taught in universities and colleges. That is true. But he wants more: he wants Mendelism-Morganism to be still more widely propounded. He wants us to have many more Mendelist-Morganist Masters and Doctors of Science who would still more extensively propagate Mendelism-Morganism in our universities and colleges. That, in fact, is what Academician Zhukovsky is driving at in a large section of his article, and that reflects his general line as Chairman of the Biological Commission.

No wonder therefore that the Commission put up all sorts of obstacles in the case of theses on genetics whose authors attempted, even if ever so timidly, to develop this or that principle of Michurin genetics. On the other hand, theses by Morganists, enjoying P. M. Zhukovsky's encouragement, appeared and were passed on favourably not at all so rarely—in any event, much oftener than the interests of true science required. True enough, theses with a Morganist tendency appeared more rarely than Academician P. M. Zhukovsky would have liked. But there are reasons for this. Under the influence of the Michurin criticism of Morganism young scientists with an insight into questions of philosophy have in recent years come to realise that the Morganist views are utterly alien to the world outlook of Soviet people. In this light the position of Academician P. M. Zhukovsky does not look so good, seeing that he advises young biologists to pay no heed to the Michurinists' criticism of Morganism, but to go on developing the latter.

Soviet biologists are right when they are suspicious of the Morganist views and refuse to listen to the scholasticism of the chromosome theory. They stand to gain, always and in everything, if they will ponder more often on what Michurin said of this very scholasticism.

I. V. Michurin held that Mendelism ". . . contradicts the truth of nature, before which no artful structure reared out of wrongly understood phenomena can stand up". "What I would like", he wrote, "is that the thinking unbiased observer should stop at this and personally test the truth of these conclusions; they represent a basis which we bequeath to naturalists of coming centuries and milleniums."[17]

[17] I. V. Michurin, *Works*, Vol. III, pp. 308-309 (Russian).

9. FOR A CREATIVE SCIENTIFIC BIOLOGY

I. V. MICHURIN laid the foundations for the science of regulating the nature of plants. These foundations have wrought a change in the very method of thinking in dealing with problems of biology.

A knowledge of *causal* connections is essential for the practical work of regulating the development of cultivated plants and domestic animals. For biological science to be in a position to render the collective farms and State farms ever more assistance in obtaining higher crop yields, higher yields of milk, etc., it must comprehend the complex biological inter-relations, the laws of the life and development of plants and animals.

A scientific handling of practical problems is the surest way to a deeper knowledge of the laws of development of living nature.

Biologists have paid very little attention to the study of the inter-relations, the natural-historical connections that exist between individual bodies, individual phenomena, parts of individual bodies and links of individual phenomena. Yet only these connections, inter-relations, and natural interactions enable us to understand the process of development, the essence of biological phenomena.

But when living nature is studied in isolation from practical activity the scientific principle of the study of biological connections is lost.

The Michurinists, in their investigations, take the Darwinian theory of evolution as their basis. But in itself Darwin's theory is absolutely insufficient for dealing with the practical problems of Socialist agriculture. That is why the basis of contemporary Soviet agro-biology is Darwinism transformed in the light of the teaching of Michurin and Williams and thereby converted into Soviet creative Darwinism.

Many problems of Darwinism assume a different aspect as the result of the development of our Soviet agro-biological science, of the Michurin trend in agro-biology. Darwinism has not only been purified of its deficiencies and errors and raised to a higher level, but—in a number of its principles—has undergone a considerable change. From a science which primarily *explains* the past history of the organic world, it is becoming a creative, *effective* means of systematically mastering living nature, making it serve practical requirements.

Our Soviet Michurinist Darwinism is a creative Darwinism which

poses and solves problems of the theory of evolution in a new way, in the light of Michurin's teaching.

I cannot in this report touch on many of the theoretical problems of great practical significance. I shall dwell briefly on only one of them—namely, the question of intra- and inter-specific relations in living nature.

The time has come to take a different view of the question of the formation of species, approaching it from the angle of the transition of quantitative accumulation into qualitative distinctions.

We must realise that the formation of a species is a transition—in the course of historical process—from quantitative to qualitative variations. Such a leap is prepared by the vital activity of organic forms themselves, as the result of quantitative accumulations of responses to the action of definite conditions of life, and that is something that can definitely be studied and directed.

Such an understanding of the formation of species, an understanding of its natural laws, places in the hands of biologists a powerful means of regulating the vital process itself and consequently also the formation of species.

I think that in posing the question this way we make take it for granted that what leads to the formation of a new specific form, to the formation of a new species out of an old one, is not the accumulation of quantitative distinctions by which varieties within a species are usually recognised. The quantitative accumulations of variations which lead to the change from an old form of species to a new form are variations of *a different order*.

Species are not an abstraction, but actually existing links in the general biological chain.

Living nature is a biological chain separated, as it were, into individual links or species. It is therefore wrong to say that a species does not retain the constancy of its qualitative definiteness as a species for any length of time. To insist on that would be to regard the evolution of living nature as proceeding as if along a plane, without any leaps.

I am confirmed in this opinion by the data of experiments for the conversion of hard wheat (*durum*) into soft (*vulgare*).

Let me note that all systematists admit that these are good, unquestionable, independent species.

We know that there are no true winter forms among hard wheats, and that is why in all regions with a relatively severe winter hard wheat is cultivated only as a spring, not a winter, crop. Michurinists

have mastered a good method of converting spring into winter wheat. It has already been mentioned that many spring wheats have been experimentally converted into winter wheat. But all of those belonged to the species of soft wheat. When experiments were started to convert hard wheat into winter wheat it was found that after two, three or four years of autumn planting (required to turn a spring into a winter crop) *durum* becomes *vulgare,* that is to say, one species is converted into another. *Durum,* i.e., a hard 28-chromosome wheat, is converted into several varieties of soft 42-chromosome wheat; nor do we, in this case, find any transitional forms between the *durum* and *vulgare* species. *The conversion of one species into another takes place by a leap.*

We thus see that the formation of a new species is prepared by altered vital activity under definite new conditions in a number of generations. In our case it is necessary to bring autumn and winter conditions to bear on hard wheat in the course of two, three or four generations. Then it can change by a leap into soft wheat without any transitional form between the two species.

I think that it may be pertinent to note that what led me to study profoundly theoretical problems, such as the problem of species or of intra-specific and inter-specific relations among individuals, was never mere curiosity or a fondness for abstract theorising. I was and am led to study these questions of theory by my work in the course of which I have to find answers to thoroughly practical problems. For a correct understanding of the relations among individuals within species it was necessary to have a clear idea of the qualitative distinctions of intra-specific and inter-specific varieties of forms.

It thus became possible to find new solutions to such problems of practical importance as the combating of weeds in farming, or the choosing of grasses for the sowing of grass mixtures, or the fast and extensive afforestation of steppe areas, and many others.

That is what led me to make a new study of the problem of intra- and inter-specific struggle and competition, and after a deep and comprehensive investigation I have come to the conclusion that there exists no intra-specific struggle but mutual assistance among individuals within a species, and there does exist inter-specific struggle and competition and also mutual assistance between different species. I regret that I have so far done very little to elucidate the theoretical content and practical significance of these questions in the press.

I am coming to the end. Now, Comrades, as regards the theoreti-

cal line in biology, Soviet biologists hold that the Michurin principles are the only scientific principles. The Weismannists and their followers, who deny the heritability of acquired characters, are not worth dwelling on at too great length. The future belongs to Michurin.

V. I. Lenin and J. V. Stalin discovered I. V. Michurin and made his teaching the possession of the Soviet people. By their great paternal attention to his work they saved for biology the remarkable Michurin teaching. The Party, the Government, and J. V. Stalin personally, have taken an unflagging interest in the further development of the Michurin teaching. There is no more honourable task for us Soviet biologists than to develop creatively Michurin's teaching and to follow in all our activities Michurin's style in the investigation of the nature of the evolution of living beings.

Our Academy must work to develop the Michurin teaching. In this it ought to follow the personal example of interest in the activity of I. V. Michurin shown by our great teachers—V. I. Lenin and J. V. Stalin.

CONCLUDING REMARKS

BEFORE I pass on to my concluding remarks I consider it my duty to make the following statement.

The question is asked in one of the notes handed to me, What is the attitude of the Central Committee of the Party to my report? I answer: The Central Committee of the Party examined my report and approved it.

I shall now take up some of the points brought out at our session.

The adherents of the so-called chromosome theory of heredity who spoke here denied that they were Weismannists and all but proclaimed themselves antagonists of Weismann. On the other hand, it has been clearly shown in my report and in many of the speeches of representatives of the Michurin trend that Weismannism and the chromosome theory of heredity are one and the same thing. Mendelist-Morganists abroad make no secret of this. In my report I quoted articles by Morgan and Castle published in 1945, in which it is plainly stated that the so-called teaching of Weismann is the basis of the chromosome theory of heredity. By Weismannism (which is the same as idealism in biology) is meant any conception of heredity which takes for granted the division of the living body into two substances which are different in principle: the usual living

body, presumably possessing no heredity but subject to variations and transformations, that is to say, to development; and a special hereditary substance, presumably independent of the living body and not subject to development under the influence of the conditions of life of the ordinary living body, or the *soma*. That much is beyond any doubt. No efforts of the advocates of the chromosome theory of heredity, both those who spoke and those who did not speak at the session, to lend their theory a materialist appearance can change the character of this theory, which is essentially idealistic.

The Michurin trend in biology is a materialist trend, because it does not separate heredity from the living body and the conditions of its life. There is no living body without heredity, and there is no heredity without a living body. The living body and its conditions of life are inseparable. Deprive an organism of its conditions of life and its living body will die. The Morganists, however, maintain that heredity is isolated, something apart from the mortal living body, from what they call the soma.

Those are the principles on which we differ with the Weismannists. And connected with them is also our difference on a question which has a long history behind it, namely, the question of inheritance of characters acquired by plants and animals. The Michurinists say that inheritance of acquired characters is possible and necessary. This principle has once more been fully confirmed by the abundant factual material demonstrated at this session. Morganists, among them those who spoke at our session, cannot comprehend this principle so long as they have not fully discarded their Weismannist notions.

Some of them still find it hard to accept the idea that heredity is inherent not only in the chromosomes, but in any particle of the living body. They therefore want to see with their own eyes cases of hereditary properties and characters transmitted from generation to generation without the transmission of chromosomes.

These questions, so incomprehensible to the Morganists, can best be answered by demonstrating and explaining the experiments in vegetative hybridisation carried on extensively in our country. It was I. V. Michurin who elaborated vegetative hybridisation. And experiments in vegetative hybridisation show incontrovertibly that heredity is a property not only of the chromosomes, but of every living thing, any cells and any particles of the body. For heredity is determined by the specific type of metabolism. You need but

change the type of metabolism in a living body to bring about a change in heredity.

Academician P. M. Zhukovsky, as becomes a Mendelist-Morganist, cannot conceive transmission of hereditary properties without transmission of chromosomes. He cannot conceive that the ordinary living body possesses heredity. In his view, that is the property of the chromosomes only. He therefore does not think it possible to obtain plant hybrids by means of grafting, he does not think it possible for plants and animals to inherit acquired characters. I promised Academician Zhukovsky to show him vegetative hybrids, and I have now the pleasure of demonstrating them at this session.

In this case one of the participating plants was a strain of tomatoes with leaves not pinnate, as usual, but like those of the potato. Its fruits are red and oblong in shape.

The other strain that participated in the grafting was one with the usual pinnate tomato leaves. The fruits when ripe are not red, but yellowish white.

The strain with the potato leaves was used as the stock, and the strain with the pinnate leaves was the scion.

In the year when the graft was made no changes were observed either in the scion or in the stock.

Seeds were gathered from the fruits that had grown up on the scion and from those that had grown up on the stock. These seeds were then planted.

Most of the plants that grew up from the seeds taken from the fruits of the stock did not differ from the initial strain, that is to say, they were with potato leaves and their fruits were red and oblong in shape. Six plants, however, had pinnate leaves, and some of them had yellow fruits, that is to say, both the leaves and the fruits had changed under the influence of the other strain, the one which had been the scion.

Academician P. M. Zhukovsky has expressed doubt as to the purity of the experiments in vegetative hybridisation, pointing out that cross-pollination of the strains might have occurred—in other words, that it was a case of sexual hybridisation. But how, Comrade Zhukovsky, can the results of the experiments I demonstrate be explained by cross-pollination?

All who have had anything to do with the hybridisation of tomatoes know that when the plants with pinnate leaves and yellow fruits are cross-pollinated with the plants with potato leaves and

red fruits, the first generation will invariably have pinnate leaves, but red fruits.

But see what we have got in our experiments. The leaves are indeed pinnate, but the fruits are not red but yellow. How, then, can these results be explained by accidental cross-pollination.

Here are the fruits of some others of these vegetative hybrids. The leaves are also pinnate, but of the ripe fruits on the stalk, one, as you see, is red and the other yellow. Variety within a single plant is a quite frequent phenomenon among vegetative hybrids. It should be borne in mind that vegetative hybridisation is not the usual mode of the union of strains, not the one that has developed in the course of their evolution. That is why as the result of grafting we often get organisms that are shaken and therefore prone to vary.

It is not in all plants by any means that we can observe easily perceptible alterations in the year of the grafting or even in the first seed generation. None the less we already have every ground to assert that every graft of a plant in its youthful stage produces changes in heredity. To prove this point we are going on with our work on vegetative hybrids of tomatoes at the Institute of Genetics of the Academy of Sciences of the U.S.S.R.

I shall now show you plants of the second seed generation obtained from the same graft; but these are from seeds taken from plants which gave no perceptible alterations in the first seed generation. On a number of plants from the second seed generation the leaves are changed—they are not like potato leaves in appearance, but pinnate, and the fruits are yellow. In this case, too, there is no reason to doubt the purity of the work or to suspect cross-pollination. In the first generation these plants had potato leaves and red fruits. If the pinnate leaves in the plants of the second generation are the result of cross-pollination, why are the fruits not red but yellow?

We thus see that as the result of grafts we obtain directed, adequate alterations; we obtain plants combining the characters of the strains joined in the grafting, that is to say, we get true hybrids. New formations are also observed. For example, among the progeny of the same graft there are plants that have borne small fruits, like those of uncultivated forms. But we all know that in the case of sexual hybridisation, too, we observe, besides the transmission to the progeny of characters of the parent forms, also the appearance of new forms.

I could cite many more cases of the production of vegetative hybrids. It is no exaggeration to say that there are hundreds and thousands of them in our country. The Michurinists not only understand how vegetative hybrids are produced, but produce them in large numbers from numerous varieties.

I have dwelt at length on vegetative hybrids because they provide instructive material of great significance. For not only Mendelists, but even materialists who have not seen vegetative hybrids, may refuse to believe that anything that is alive, any particle of a living body, possesses heredity as well as the chromosomes. This can be easily demonstrated by the examples of vegetative hybridisation. Chromosomes cannot be transferred from stock to scion and vice versa—that is a fact no one disputes. Yet hereditary properties, such as the colouring of the fruit, its shape, the shape of the leaves, and others, are transmitted from scion to stock and from stock to scion. Now show us any properties of two breeds blended into one by means of sexual hybridisation—in the case of tomatoes, for instance—which could not be blended or have not been blended by the Michurinists, by means of vegetative hybridisation.

Thus experiments in vegetative hybridisation provide unmistakable proof that any particle of a living body, even the juices exchanged between scion and stock, possesses hereditary qualities.

Does this detract from the role of the chromosomes? Not in the least. Is heredity transmitted through the chromosomes in the sexual process? Of course it is.

We recognise the chromosomes. We do not deny their presence. But we do not recognise the chromosome *theory* of heredity. We do not recognise Mendelism-Morganism.

Let me remind you that Academician P. M. Zhukovsky promised that if I showed him vegetative hybrids, he would believe and revise his position. I have now kept my promise to show him vegetative hybrids. But I must remark, firstly, that dozens and hundreds of such hybrids could be seen in our country for at least a decade now; and, secondly, is it possible that Academician Zhukovsky, a botanist, does not know what is known to many, even if not all, horticulturalists—namely, that in decorative horticulture a great deal has been done, and is being done, to change the heredity of plants by means of grafting?

Some of the Morganists who spoke at this session alleged that, together with the chromosome theory of heredity, Lysenko and his

followers reject all the experimental facts obtained by Mendelist-Morganist science. Such allegations are wrong. We do not reject any experimental facts, and this holds good for the facts concerning chromosomes.

Some go so far as to assert that the Michurin trend denies the action upon plants of factors producing mutations, such as X-rays, colchicine, etc. But how is it possible to assert anything of the sort? Certainly, we Michurinists cannot deny the *action* of such factors. We recognise the action of the conditions of life upon the living body. Why then should we refuse to recognise the action of such potent factors as X-rays or a strong poison like colchicine, etc.? We do not deny the action of substances which produce mutations. But we insist that such action, which penetrates the organism not in the course of its development, not through the process of assimilation and dissimilation, can only rarely and only *fortuitously* lead to results useful for agriculture. It is not the road of systematic selection, not the road of progressive science.

The numerous and lengthy efforts made in the Soviet Union to produce polyploid plants with the aid of colchicine and similar potent factors have in no way led to the results so widely advertised by the Morganists.

A great deal has been said and written to the effect that geranium began to give seeds after its chromosome outfit had been increased. But this geranium is not being grown for the market, and I, as a scientist, venture the opinion that it never will be so grown, because it is much more practical to propagate geranium by cuttings. Currants, for example, can be grown from seeds, but in practice they are propagated by cuttings. Potatoes can also be grown from seeds, but it is more practical to plant tubers. As a rule, plants which can be propagated both by seeds and by cuttings (i.e., by the vegetative method) are propagated for practical ends by the latter method.

This does not mean that we minimise the importance of the fact that a geranium has been obtained which is capable of producing seeds. If not for practical ends, this form can be of use in the study of plant breeding.

And what I have said of geranium applies also to mint.

What other polyploids are often represented by the Morganists as highly important achievements? Wheat, millet, buckwheat, and a few other plants. But, according to the statements which we have heard here from the Morganists themselves (A. R. Zhebrak, for

example), all these polyploids—wheat, millet, buckwheat—have so far, as a rule, been found to be of small fertility, and their authors themselves have refrained from recommending their cultivation for practical ends.

There only remains the tetraploid kok-saghyz. This is the first year it is being tested on collective farms. It goes without saying that, if it proves to be good, it ought to be introduced in practical farming. So far, however, according to the data of three years' testing at Government experimental stations, it is not superior to the ordinary diploid strains, such as Bugakov's, for example. This is the first year tetraploid kok-saghyz is being tested on collective farms. In another two or three years we shall have practical proof of how good it is. I sincerely hope that it may prove to be the best of all kok-saghyz strains. The country can only gain thereby.

At the same time we must not forget that among the strains of cultivated plants there are plenty of polyploids whose origin not only has nothing to do with colchicine and the theory of the production of mutations, but the entire theory of Morganism-Mendelism has no bearing whatever on it. For centuries people did not know that many good strains of pears, for example, are polyploids. But we have also as many equally good strains of pears which are not polyploid. These facts alone provide enough grounds for the conclusion that it is not the number of chromosomes that determines the quality of a strain.

There are good and bad strains of hard 28-chromosome wheat, and there are good and bad strains of soft 42-chromosome wheat.

Is it not obvious that breeding must be conducted, not with a view to the number of chromosomes, not with a view to polyploidy, but with a view to inducing good qualities and properties?

When a good strain has been produced, we can also determine the number of its chromosomes. But no one, certainly, will think of discarding a good strain only because it has turned out to be a polyploid or not a polyploid. No Michurinist, no serious-minded person generally, can approach the question from such an angle.

Our Morganists, among them some who spoke at this session, in order to adduce proof that their theory is effective, often point to some strains of bread grains which are widespread in practical farming, as, for example, *lutescens* 062, *melanopus* 069, and some other strains of long standing which they claim have been produced on the basis of Morganism-Mendelism. But actually Mendelism has nothing to do with the production of these strains. How, for

example, have strains like *lutescens* 062, *melanopus* 069, *ukrainka*, and some others been produced? They were produced by the ancient method of selection from local strains.

I shall quote here Prof. S. I. Zhegalov, who wrote in his work, *An Introduction to the Selection of Agricultural Plants*: " Under ordinary farming conditions we have to deal, not with pure forms, but with ' strains ' representing more or less complex combinations of various forms. . . . The first, perhaps, to draw attention to this fact in the first quarter of the nineteenth century [long before the appearance of Weismannism —T. L.] was the Spanish botanist Mariano Lagasca, who published his observations in Spanish. There is an interesting story extant about a visit he paid to his friend, Colonel Le Couteur, at the latter's estate on Jersey Island. During an inspection of the fields he drew the attention of his host to the considerable divergence of forms among the plants and suggested that individual forms be selected for further pure breeding. The idea appealed to Le Couteur, who selected twenty-three different forms and began to test their relative merits. As a result of the tests, he found one of the forms to be the very best, and in 1830 put it on the market as a new strain named *Talavera de Bellevue*. Since then this kind of work has been tried many times, and it has led to the production of variable strains. In substance, it consists in separating the initial mixtures into their component parts. That is why this method is known as '*analytical selection*'. At present it is the principal method employed in work with self-pollinating plants and is systematically applied by all stations, particularly in the early stages of the work on plants formerly little affected by selection."[18]

A little farther Prof. S. I. Zhegalov writes: "The method of analytical selection lends meaning to an aphorism credited to Jordan: 'To obtain a new strain we must first possess it'."[19]

Comrade Shehurdin, was the form of wheat now called *lutescens* 062 to be found among the native "*Poltavka*" strain or not? [Voice from the audience: "Yes, positively."] The same is true of the forms called *ukrainka* and *melanopus* 069.

That is why S. I. Zhegalov accepts the aphorism that in applying the method of analytical selection it is necessary, when we want to produce a new strain, first to possess it. The named strains, to which our Mendelists usually point, have indeed been obtained in this manner.

[18] S. I. Zhegalov, *An Introduction to Selection of Agricultural Plants* (Russian), 1930, pp. 79-80.

[19] Ibid., p. 83.

We Michurinists, however, cannot agree with Prof. S. I. Zhegalov and his interpretation of Darwinian selection. For it is possible to begin to select plants with scarcely perceptible and still feeble useful characters, in order to reinforce and develop these useful characters by repeated selection and proper cultivation. But, as is obvious to any one, the described Darwinian method of selection has no bearing whatever on the Mendelist-Morganist theories.

It should be mentioned that formerly strains were bred only on the basis of the above method. For that matter, this method is being applied today and will be applied in future. It is useful, and practical breeders who successfully apply it should be appreciated and encouraged.

Far from rejecting the method of continuous improving selection, we, as is well known, have always insisted on it. Morganists, on the other hand, have ridiculed the application of repeated improving selections in practical seed growing.

Weismannism-Morganism has never been, nor can it be, a science conducive to the systematic production of new forms of plants and animals.

It is significant that abroad, in the United States for example, which is the home of Morganism and where it is so highly extolled as a theory, this teaching, because of its inadequacy, has no room in practical farming. Morganism as a theory is being developed *per se,* while practical farmers go their own way.

Weismannism-Morganism does not reveal the real laws of living nature; on the contrary, since it is a thoroughly idealistic teaching, it creates an absolutely false idea about natural laws.

For instance, the Weismannist conception that the hereditary characteristics of an organism are independent of environmental conditions has led scientists to affirm that the property of heredity (i.e., the specific nature of an organism) is subject only to chance. All the so-called laws of Mendelism-Morganism are *based entirely on the idea of chance.*

Here are a few examples.

" Gene " mutations, according to the theory of Mendelism-Morganism, appear fortuitously. Chromosome mutations are also fortuitous. Due to this, the direction of the process of mutation is also fortuitous. Proceeding from these invented fortuities, the Morganists base their experiments too on a fortuitous choice of substances that might act as mutation factors, believing that they are thereby acting on their postulated hereditary substance, which

is just a figment of their imagination, and hoping to obtain fortuitously what may by chance prove to be of use.

According to Morganism, the separation of the so-called maternal and paternal chromosomes at reduction division is also a matter of pure chance. Fertilisation, according to Morganism, does not occur selectively, but by the chance meeting of germ cells. Hence the splitting of characters in the hybrid progeny is also a matter of chance, etc.

According to this sort of "science" the development of an organism does not proceed on the basis of the selectivity of conditions of life from the environment, but again on the basis of the assimilation of substances fortuitously entering from without.

On the whole, living nature appears to the Morganists as a medley of fortuitous, isolated phenomena, without any necessary connections and subject to no laws. Chance reigns supreme.

Unable to reveal the laws of living nature, the Morganists have to resort to the theory of probabilities, and, since they fail to grasp the concrete content of biological processes, they reduce biological science to mere statistics. It is not for nothing that statisticians, like Galton, Pearson, and latterly Fisher and Wright, are also regarded as founders of Mendelism-Morganism. Probably, that is also the reason why Academician Nemchinov has told us here that, as a statistician, he had no difficulty in mastering the chromosome theory of heredity.

Mendelism-Morganism is built entirely on chance; this "science" therefore denies the existence of necessary relationships in living nature and condemns practical workers to fruitless waiting. There is no effectiveness in such science. With such a science it is impossible to plan, to work toward a definite goal; it rules out scientific foresight.

A science which fails to give practical workers a clear perspective, the power of finding their bearings and confidence that they can achieve practical aims does not deserve to be called science.

Physics and chemistry have been rid of fortuities. That is why they have become exact sciences.

Living nature has been developing and is developing on the basis of strict laws inherent in it. Organisms and species develop in line with natural necessities inherent in them.

By ridding our science of Mendelism-Morganism-Weismannism we will expel fortuities from biological science.

We must firmly remember that *science is the enemy of chance.*

That is why Michurin, who was a transformer of nature, put forward the slogan: "We must not wait for favours [i.e., lucky chances—T. L.] from nature; our task is to wrest them from her."

Aware of the practical sterility of their theory, the Morganists do not even believe in the possibility of the existence of an effective biological theory. Ignorant even of the ABC of the Michurinist science, they cannot to this day imagine that for the first time in the history of biology a truly effective theory has come into being —the Michurin teaching.

A great deal can be scientifically predicted on the basis of the Michurin teaching, thus freeing practical plant breeders to an ever-increasing extent from the elements of chance in their work.

Michurin himself elaborated his theory, his teaching, only in the process of solving problems of practical importance, in the process of the production of good strains. That is why *the Michurin teaching is, by its very spirit, inseparable from practical activity.*

Our system of collective farming and our socialist agriculture created the conditions for the flowering of the Michurin teaching. Let us recall Michurin's words: "In the person of the collective farmer the history of agriculture of all times and all nations has an entirely new type of farmer, one who has joined issue with the elements marvellously armed technically and acting on nature as a man with the aims of a renovator."[20]

"I see", wrote I. V. Michurin, "that the system of collective farming, by means of which the Communist Party is inaugurating the great work of renovating the land, will lead labouring humanity to real power over the forces of nature.

"The great future of our entire natural science is in the collective farms and state farms."[21]

The Michurin teaching is inseparable from the practical collective farm and State farm activity. It is the best form of unity of theory and practice in agricultural science.

It is clear to us that the Michurin movement could not extensively develop, if there were no collective farms and State farms.

Without the Soviet system I. V. Michurin would have been, as he himself wrote, "an obscure hermit of experimental horticulture in Tsarist Russia".[22]

[20] I. V. Michurin, *Works* (Russian), Vol. I, p. 477.
[21] Ibid., p. 477.
[22] I. V. Michurin, *Works*, Vol. IV, p. 116.

The strength of the Michurin teaching lies in its close association with the collective farms and State farms, in the fact that it *elucidates profoundly theoretical problems by solving important practical problems of socialist agriculture.*

Comrades, our session is drawing to its close. This session has vividly demonstrated the strength and potency of the Michurin teaching. Many hundreds of representatives of biological and agricultural science have taken part in it.

They have come here from all parts of our vast country. They have taken a lively interest in the discussion on the situation in biological science and, convinced in the course of many years of practical activity that the Michurin teaching is right, are ardently supporting this trend in biological science.

The present session has demonstrated *the complete triumph of the Michurin trend over Morganism-Mendelism.*

It is truly a historic landmark in the development of biological science.

I think I shall not be wrong if I say that this session has been a great occasion for all workers in the sciences of biology and agriculture.

The Party and the Government are showing paternal concern for the strengthening and development of the Michurin trend in our science, for the removal of all obstacles to its further progress. This imposes upon us the duty to work still more extensively and profoundly to arm the State farms and collective farms with an advanced scientific theory. That is what the Soviet people expect of us.

We must effectively place science, theory, at the service of the people, so that crop yields and the productivity of stock-breeding may increase at a still more rapid pace, that labour on State farms and collective farms may be more efficient.

I call upon all Academicians, scientific workers, agronomists, and animal breeders to bend all their efforts and work in close unity with the foremost men and women in socialist farming to achieve these great and noble aims.

Progressive biological science owes it to the geniuses of mankind, Lenin and Stalin, that *the teaching of I. V. Michurin has been added to the treasure-house of our knowledge, has become part of the gold fund of our science.*

Long live the Michurin teaching, which shows how to transform living nature for the benefit of the Soviet people!

Long live the Party of Lenin and Stalin, which discovered Michurin for the world and created all the conditions for the progress of advanced materialist biology in our country.

Glory to the great friend and protagonist of science, our leader and teacher, Comrade Stalin!